

## **Title: “Shape-Up” with Geometry**

### **Brief Overview:**

This unit includes three lessons and an assessment to help students develop the perspective and visual perception of geometric models. Students will analyze the properties of geometric figures, explore their relationships, and construct three-dimensional models from two-dimensional representations. .

### **NCTM Content Standard/National Science Education Standard:**

Use visualization, spatial reasoning, and geometric modeling to solve problems

- Build and draw geometric figures
- Identify and build a three-dimensional object from a two dimensional representation of that object.
- Recognize geometric ideas and relationships and apply them to other disciplines and to solve problems that arise in the classroom or in everyday life.
- Identify and draw a two-dimensional representation of a three-dimensional object.

### **Grade/Level:**

Grades: 3-4

### **Duration/Length:**

3 days (60 minutes per day), ½ day used for assessment.

### **Student Outcomes:**

Students will:

- Use manipulatives in order to visualize and construct geometric figures
- Name properties of geometric figures in order to identify and construct three-dimensional objects from a two-dimensional representation of that object.
- Relate knowledge from the properties of geometric figures in order to solve problems.
- Apply knowledge of the properties of geometric figures in order to solve problems.

### **Materials and Resources:**

#### **Lesson 1**

- Overhead Geoboard (for the teacher)
- 1 Geoboard per student and rubber bands

- Virtual Geoboard  
[http://nlvm.usu.edu/en/nav/frames\\_asid\\_172\\_g\\_2\\_t\\_3.html?open=activities](http://nlvm.usu.edu/en/nav/frames_asid_172_g_2_t_3.html?open=activities)
- See Appendix A- Teacher Resource 1, 2,
- See Appendix B- Student Resource 1

## **Lesson 2**

- Overhead cubes for teacher
- 10 cubes for each student; later, add 10 more cubes
- See Appendix A- Teacher Resource 3
- See Appendix B- Student Resource 2

## **Lesson 3**

- See Appendix A- Teacher Resource 4, 5
- See Appendix B- Student Resource 3, 4, 5

## **Development/Procedures:**

### **Lesson 1**

#### **Pre-assessment**

- Create a chart displaying geometric shapes, such as a circle, triangle, square, or a rectangle. Post the chart on the board
- Elicit the names and attributes of each shape from the students. Use this activity as an informal pre-assessment.
- List geometric terms used to describe the figures. Accept many words at this point (sides, corners, angles, lines)

#### **Launch**

- Tell students that they will construct geometric shapes using a Geoboard and they will find more ways to describe the shapes.
- Display the overhead Geoboard.
- Use different color rubber bands to create a few shapes with different sides and a few with the same number of sides.
- Ask students, “What’s different about the shapes that have the same number of sides?”
- Accept several student responses and add to pre-assessment chart of geometric shapes, if relevant.

#### **Teacher Facilitation**

- Distribute a Geoboard and one rubber band to each student.
- Instruct students to create a pentagon on their boards.
- Allow students to hold up their Geoboard to share the shapes created.
- Ask, “What do you notice? Are all the shapes alike? Why or why not?”
- Instruct the students to make a shape with four sides on their Geoboard. Then, add more conditions such as, “Make a shape that has a four-sides and touches six pegs. Make a shape that uses two pegs, has a square in the center and two triangles on the side.” Each time allowing them to share their results.

- Explain, “Every shape we’ve looked at or created today is a polygon. Ask the students if they can create a good definition of polygon based on what they’ve seen or made.
- Model creating a polygon (a hexagon) on the overhead Geoboard, and then draw that figure on the overhead Geoboard dot paper (Teacher Resource 1.)
- Ask students to help you count the number of units used.
- Elicit the name of the polygon from your students. Write the proper name on the Geoboard dot paper. Discuss why it is called a hexagon.

### **Student Application**

- Instruct the students to make several polygons using the Geoboard and to record each one they make on the Geoboard dot paper.
- Distribute the Geoboard dot paper (Student Resource 1) for recording purposes.
- Instruct students to give their polygon the proper name if they know it.

### **Embedded Assessment**

- Check to see if the student is able to create a variety of polygons. Note whether some students were able to properly name the polygon.
- Discuss with students the different shapes they created. Ask them to describe what they did to create the shape.
- Discuss the names of the shapes..
- Generate ideas on how to identify certain shapes that students had difficulty naming.
- Refer to charts used in the pre-assessment and add any new vocabulary.
- Check vocabulary words frequently used in describing the different shapes.

### **Reteaching/Extension**

- Display a triangle shape on overhead Geoboard.
- Give an example of a riddle such as, “I’m creating a shape that uses four pegs on the left side, one corner, and three sides
- Ask students to create a riddle describing another shape on the overhead Geoboard.
- Allow time for students to share their riddles with the clues or small groups.
- Use the Teacher Resource 2 to give more clues on different shapes if needed.

## **Lesson 2**

### **Pre-Assessment**

- Display a cube for the class to see and ask students to share what they know about this space figure and its attributes.
- Check to see that students are able to identify the edge, face, and vertex of a cube.

- Review vocabulary if necessary.

### **Launch**

- Introduce the cube manipulatives to the students,
- Give each student about 10 different colored cubes to play with for a few moments.
- Review the face(s) of the cube. Ask students to determine how many faces a cube has.
- Allow time for them to share their ideas.
- What do you think will happen when you put 2 cubes together :  
-How many faces will you have now?  
-How many faces do you have when you put 3 cubes together?
- Allow time for students to share their thinking.

### **Teacher Facilitation**

- Follow the steps on the overhead (Teacher Resource 3) to build a three-dimensional shape.
- Instruct the students to watch and build it with their cubes as you model it.
- Instruct the students to look at the structure created: from the front, back, left side, right side, and from a bird's eye view.
- Ask students how many cubes are in each column? Each row?
- How might this help us draw a map of our structure?
- Distribute 1-cm dot paper (Student Resource 2) and instruct students to draw a direct view: left/right, front/back, and bird's eye view.
- Walk around the classroom to see if any student needs help.
- When students have finished drawing perspectives, review the drawings on the overhead with the class.

### **Student Application**

- Invite students to work with a partner.
- Using additional cubes, one student creates a building with several towers, while the other makes the map of the structure.
- Reverse the roles and repeat.

### **Embedded Assessment**

- Do the students see the relationship between the 3-dimensional structure and the 2-dimensional map?
- Teacher does an informal assessment by watching each student work, and engaging in a one-on-one conversation with the student.

### **Reteaching/Extension**

- Instruct the students to create an original three-dimensional space figure and record the side, front, back, and bird's eye view of it on graph paper (Student Resource 3.)
- Explain that their figures will be placed in a brown paper bag and labeled with their names.

- Their drawings will be placed in a center for classmates to use to build their designs.
- Once built, students can check the bag to see if their structures matched the drawings.

### **Lesson 3**

#### **Launch**

- Place a three-dimensional figure in a paper bag.
- Instruct a student to reach into the bag without looking and share one attribute of the figure.
- Repeat with various students until all attributes have been shared.
- Remove the figure from the bag to observe and verify their predictions.

#### **Summative Assessment:**

- The teacher will place a drawing of a three-dimensional figure on the overhead projector (Step A of the BCR-Teacher Resource 4).
- Distribute the BCR (Student Resource 4.) and cubes to each student.
- Allow time for students to construct the figure illustrated in Step A using their cubes.
- Teacher will check to see if each student built the correct figure.
- Record their score for Step A on a class list as you move around the room.
- Allow time for the students to complete Step B of the BCR.
- The students will write and explain how they build the structure from the map.
- Allow time for the students to share their responses.

#### **Extension:**

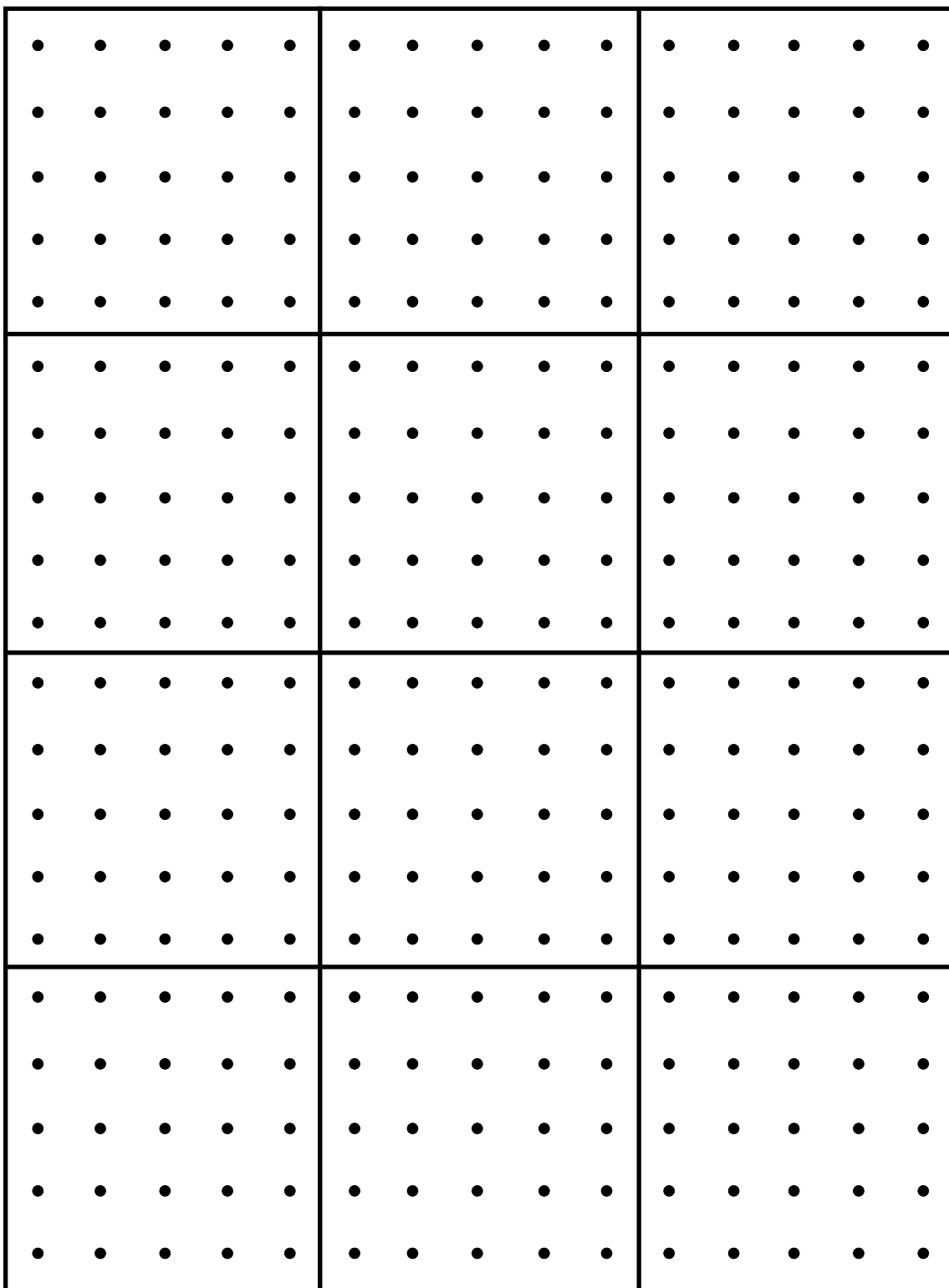
- Place a three-dimensional drawing on the overhead.
- Ask students to create this figure using connecting cubes.
- Distribute 1-cm dot paper (Student Resource 5) to each student and instruct them to draw a direct view from each of these perspectives: left, right, back, and bird's eye view.
- Instruct students to complete the drawings as a final personal achievement.

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### Geoboard Dot Paper



## Riddle clues for **Reteaching/Extension** Using the Geoboard

Create a shape:

1.

- That uses 9 pegs
- Is a triangle (has three sides)
- Has two squares inside the figure

2.

- Has four corners
- Three pegs inside the figure
- Two equally long sides
- Two equally short sides

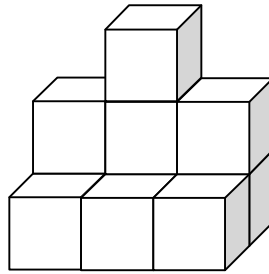
3.

- Has a triangle inside
- Uses 11 pegs
- Has three units on one side
- Has four units on the bottom side

**Building Geometric Three-Dimensional Images:**

- 1) Place 3 cubes in a straight line.
- 2) Place another 3 cubes in a straight line, and attached to #1 so both lines are parallel).  
*This should look like a 2-cube by 3-cube rectangle.*
- 3) Place another 3 cubes in a straight line.
- 4) Attach this third row of cubes on the top of one of the rows of our 2 cubes by 3 cubes rectangle.  
*This should look like we are building up, or making a second level on our figure.*
- 5) Now, attach a single cube to the middle cube on the second level, so that you have a single cube on a third level of our figure.

**Does your figure look like this?**



**Does your map look like this?**

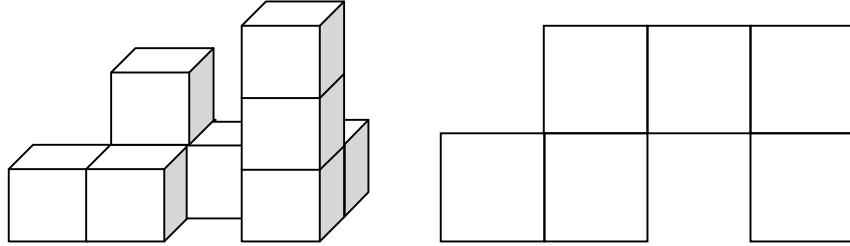
2	3	2
1	1	1

**Lesson 3**  
**Summative Assessment**

**Brief Constructed Response**

Observe the drawing of a three-dimensional figure.

**Step A**



Construct the figure illustrated in Step A using the snap cubes provided.

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**Step B**

Use what you know about constructing three-dimensional figures to explain why your answer is correct. Use words and/or numbers in your explanation.

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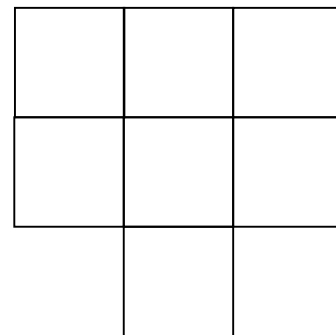
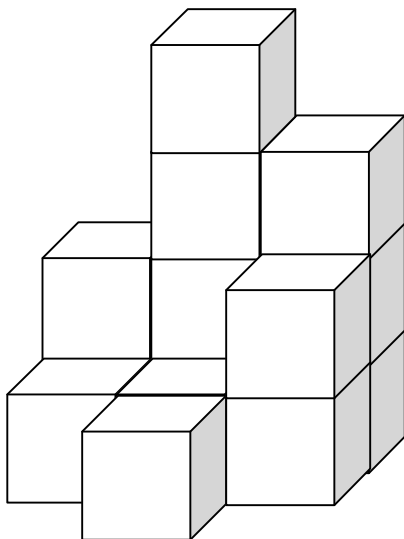
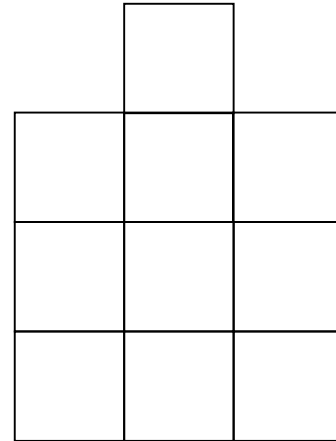
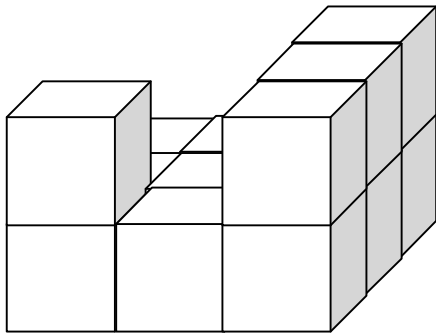


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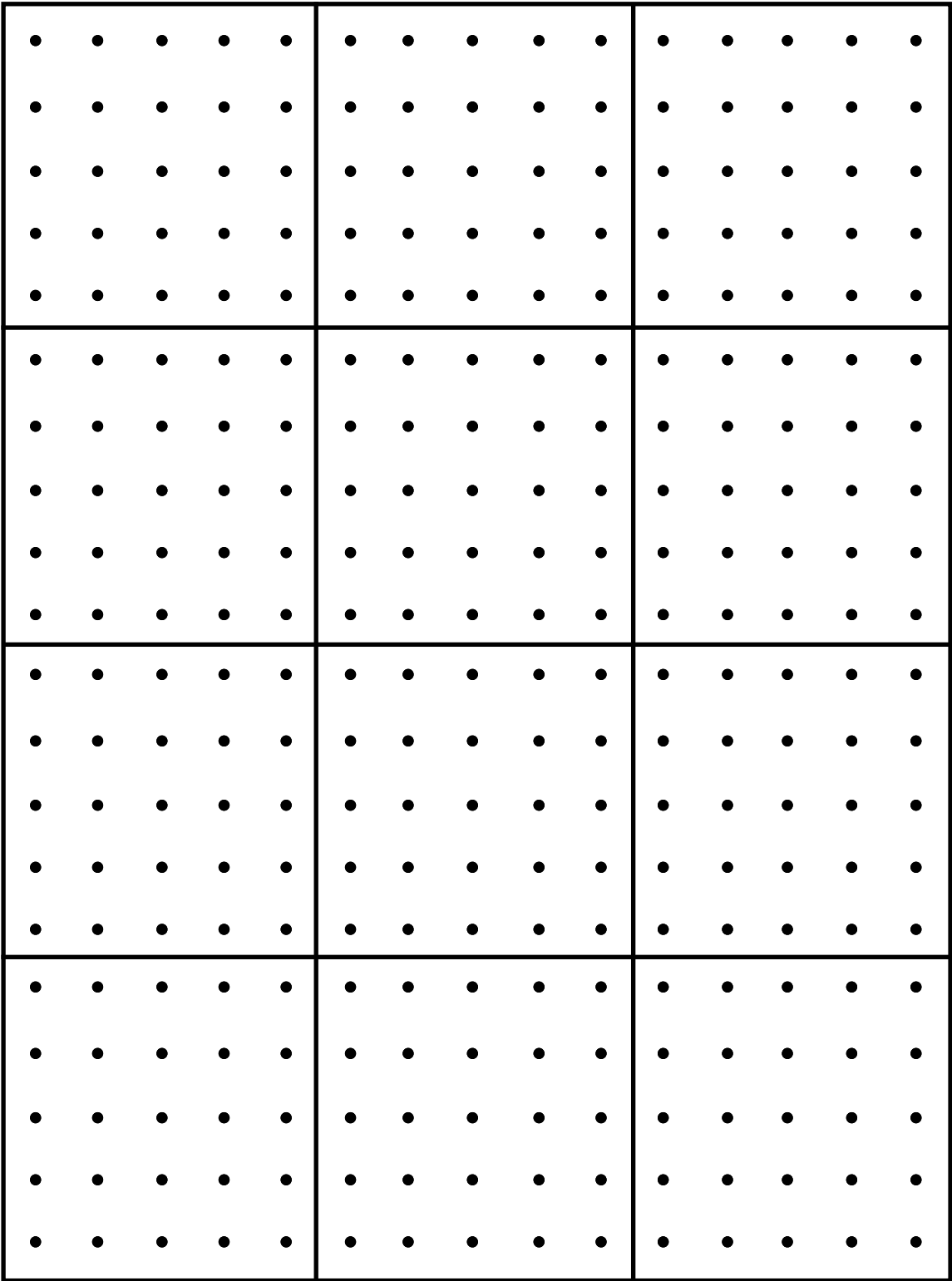


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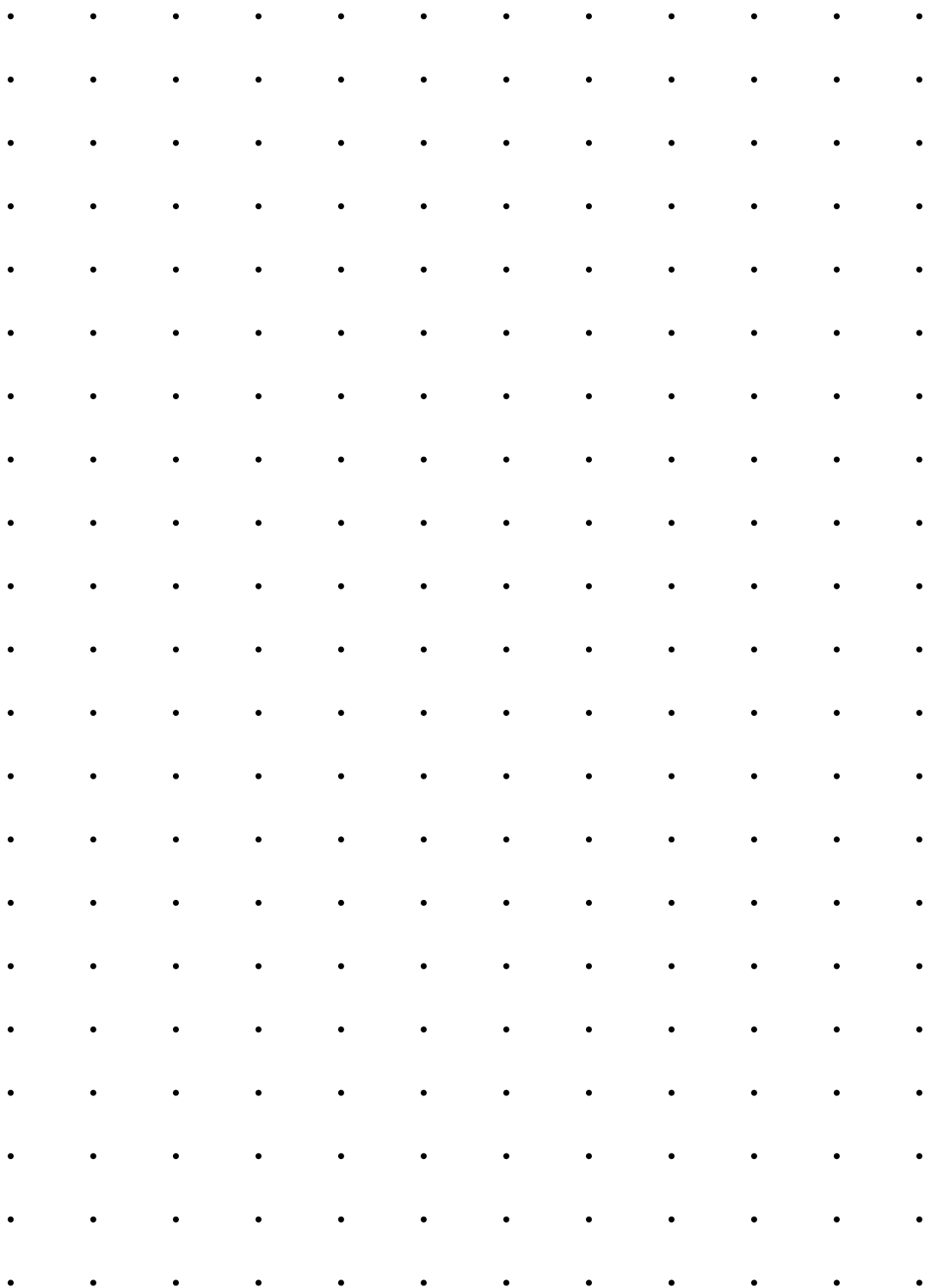
**Overhead**  
**Two dimensional representation of a three dimensional figure**



Geoboard Dot Paper

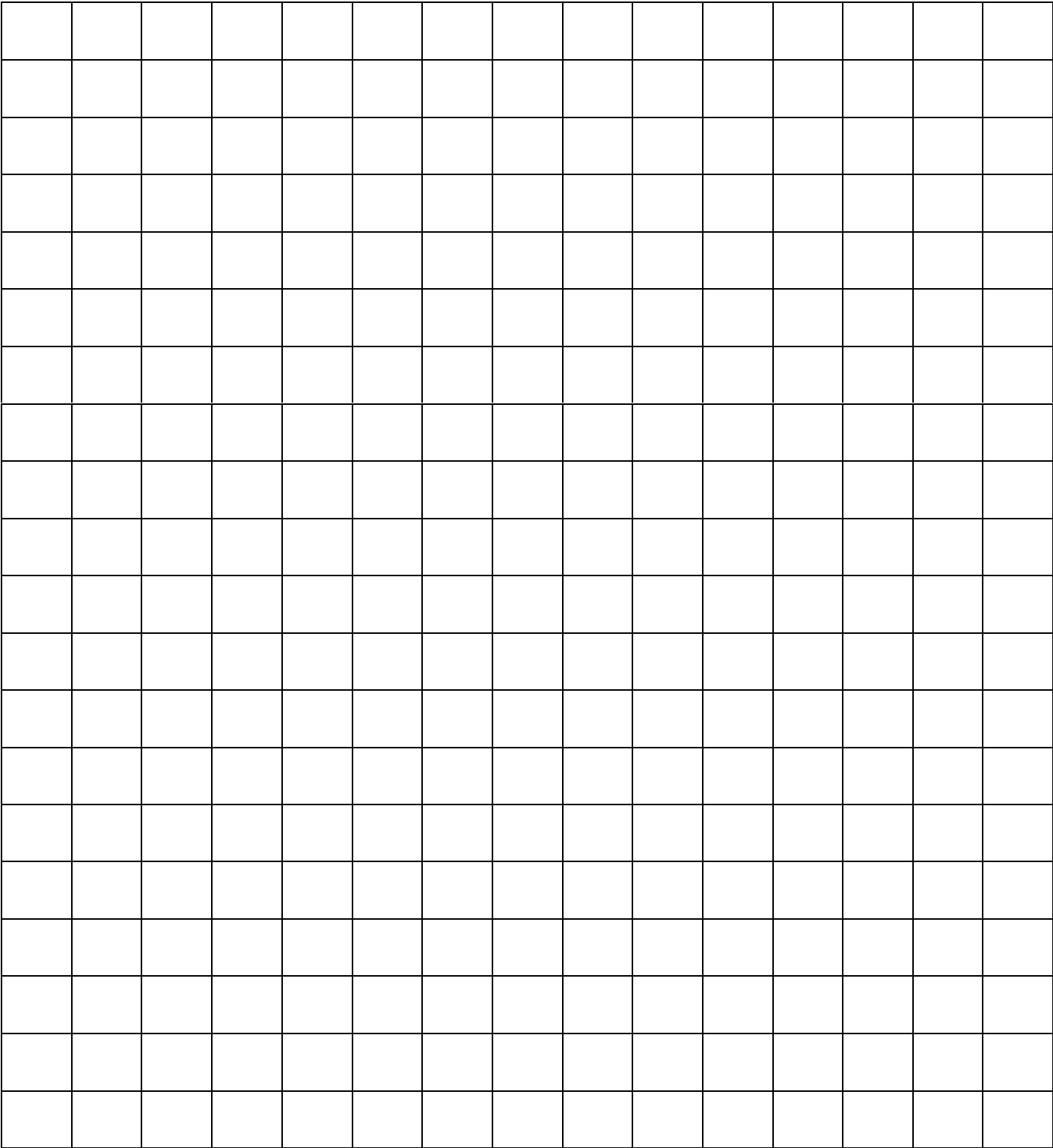


## One-Centimeter Dot Paper



**Graph Paper**

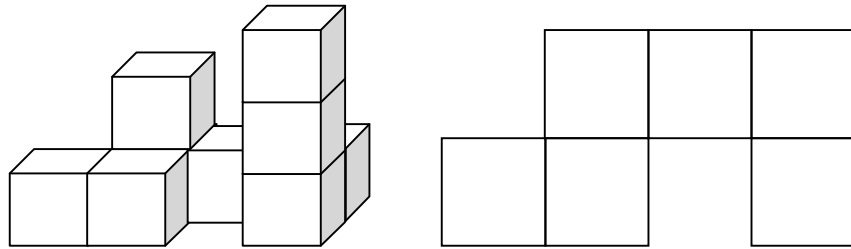
**Student Resource 3**  
**Lesson 2 Extension**



## Lesson 3-Summative Assessment

## Brief Constructed Response

Observe the drawing of a three-dimensional figure.

**Step A**

Construct the figure illustrated in step A using the snap cubes provided.

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**Step B**

Use what you know about constructing three-dimensional figures to explain why your answer is correct. Use words and/or numbers in your explanation.

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# One-Centimeter Dot Paper

